

# Transport, Energy and Emissions In London

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# Outline

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- Background on London
- Legal and policy background
- Data sources and data collection methods
  - Transport
  - Emissions
  - Energy
- Methodology for emissions estimation
- Conclusions



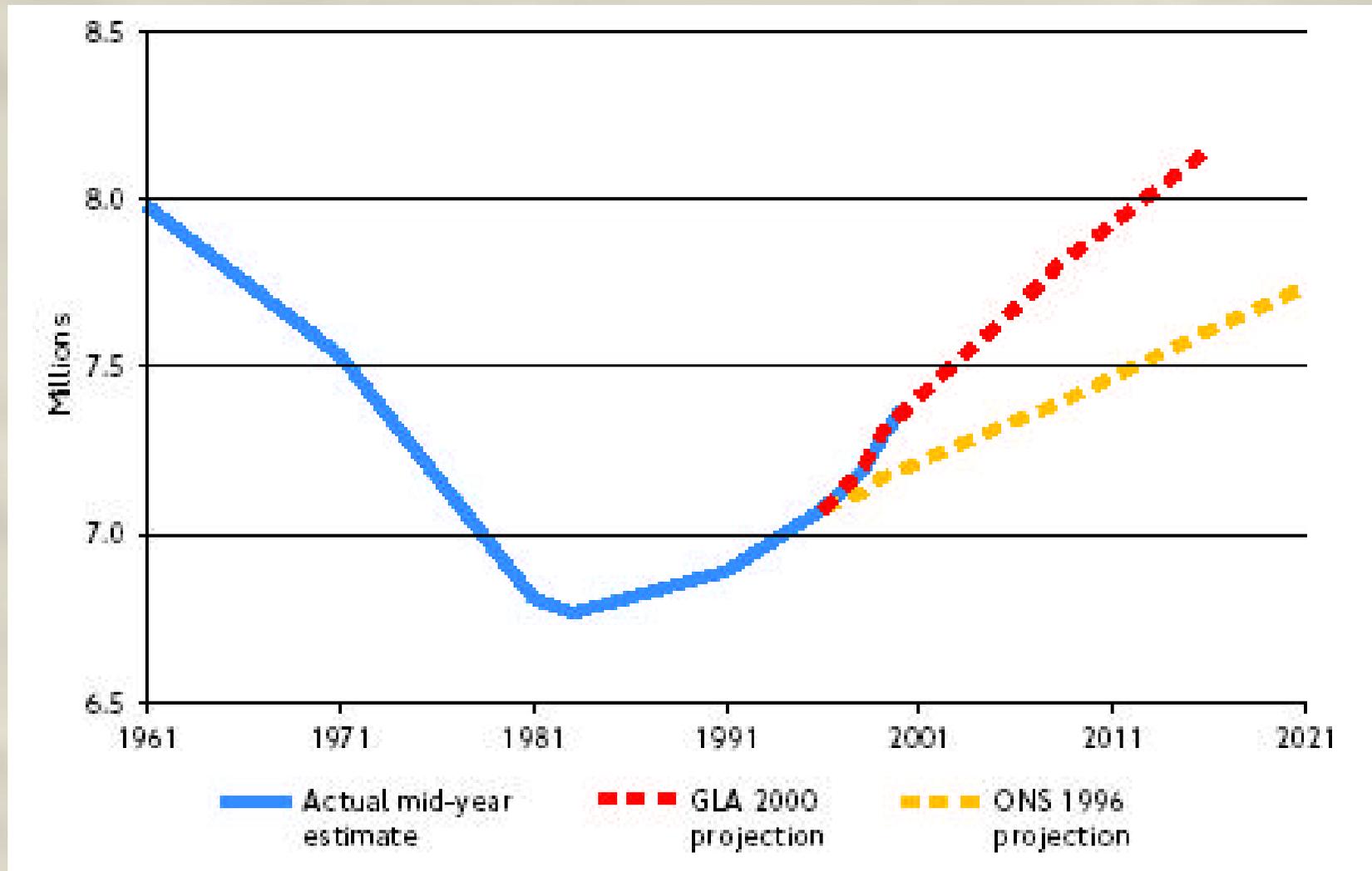
# London: Background

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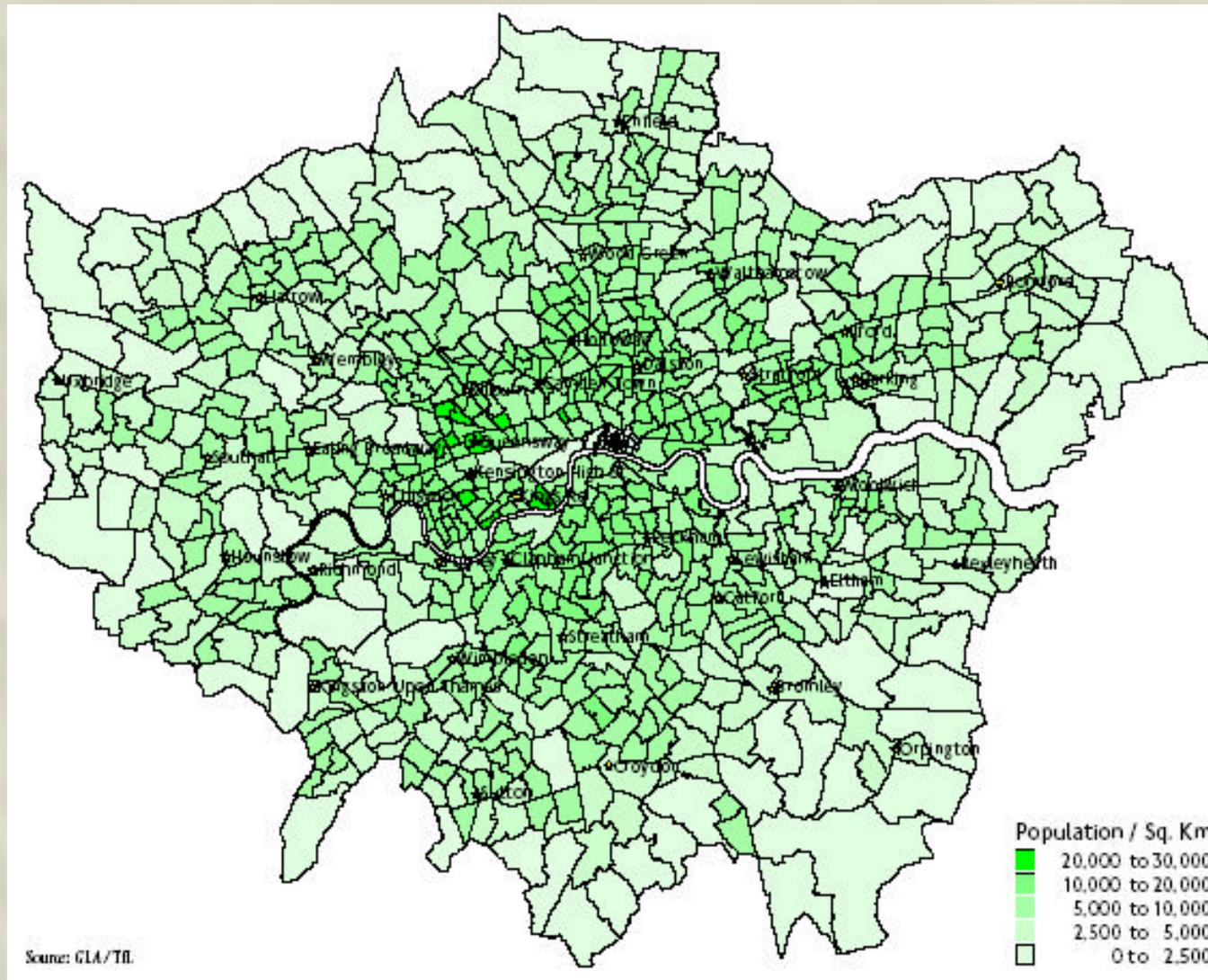
- Area ~  $1.6 \times 10^3$  Km<sup>2</sup>
- Population ~ 7.5m; imports singles, exports families
- Employment ~ 4.5m jobs, of which 1.3m are in central London
- Travel ~ 33m trips per day
- Accounts for 12% of UK population and 20% of UK GDP



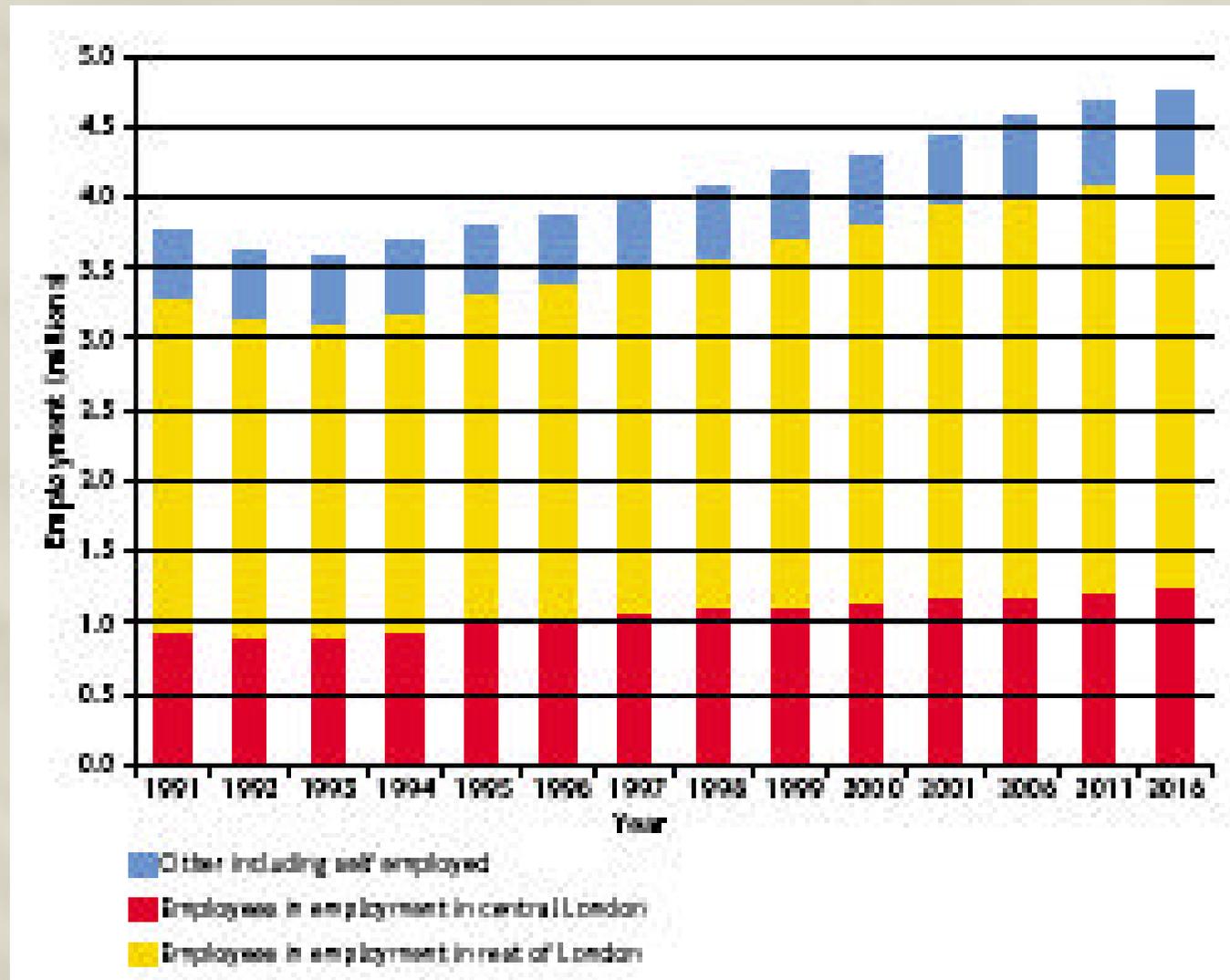
# London: Population



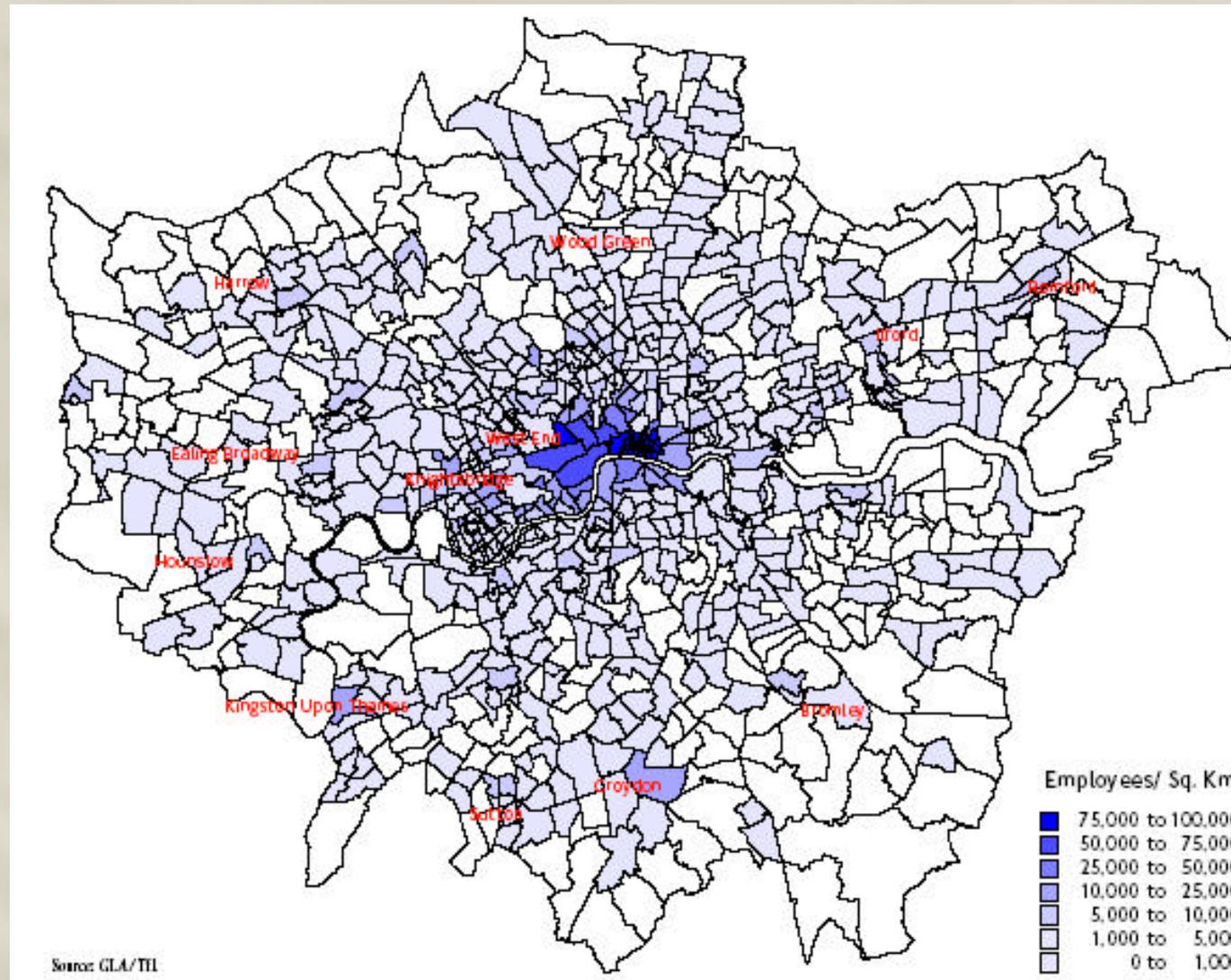
# London: Population density



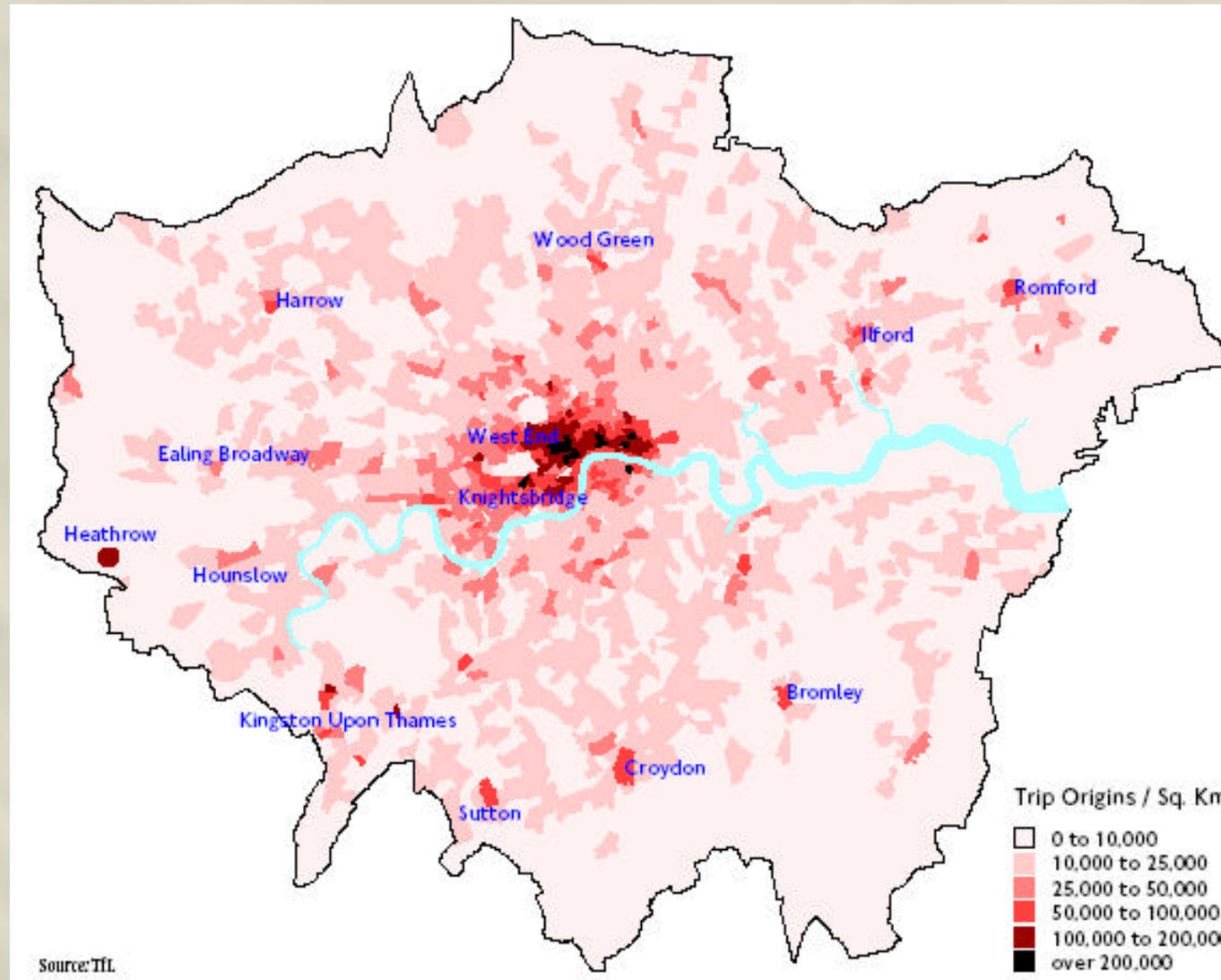
# London: Employment



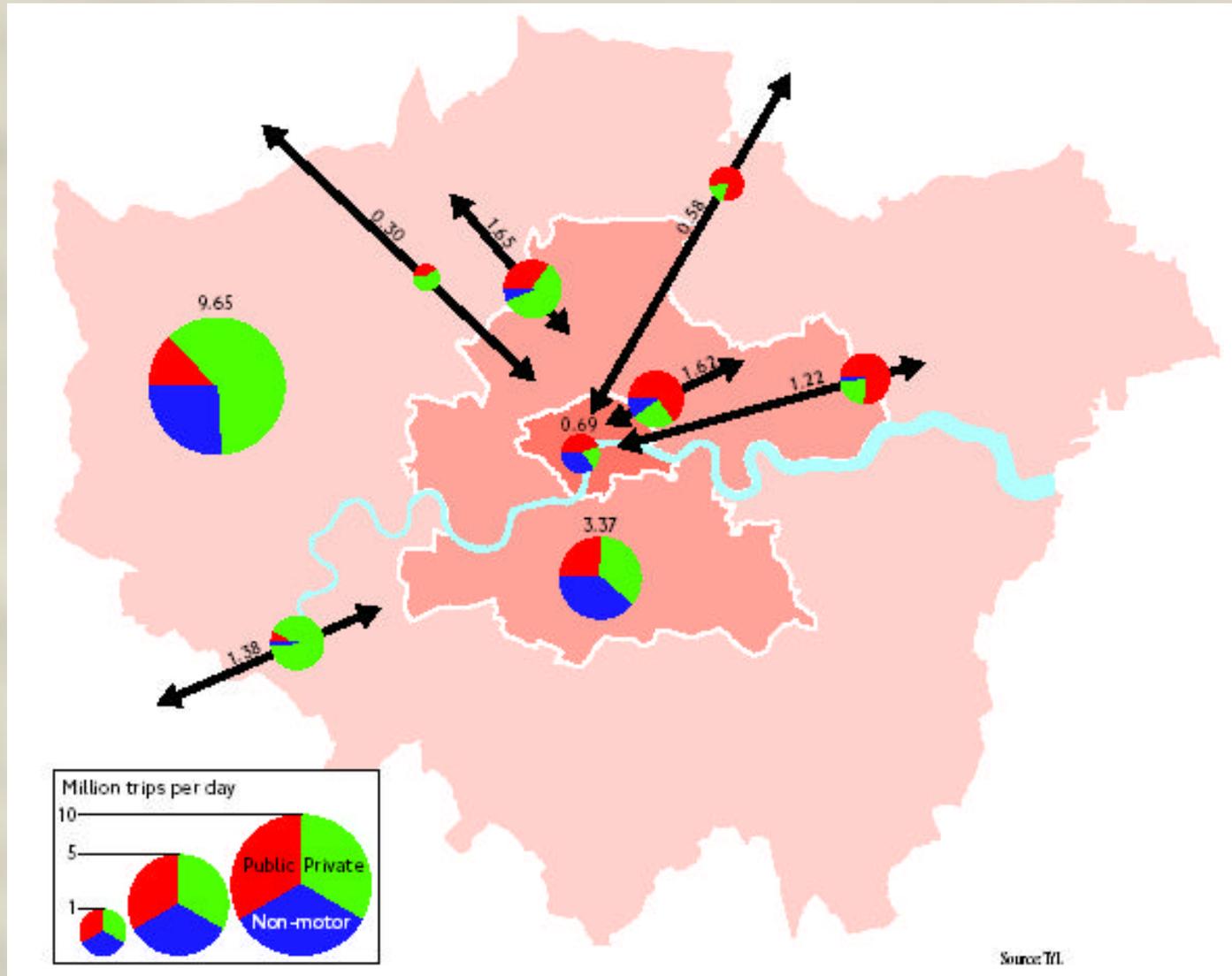
# London: Employment density



# London: Trip-end density



# London: AM Peak mode split (trips)



Source: TfL



# London: Legal and policy

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- Greater London Authority established in 2000, together with (first) elected mayor. Responsible for:
  - Transport
  - Air quality
  - Energy
  - and several other municipal functions
- EU directives and UK national air quality strategy set limits for  $\text{NO}_2$ ,  $\text{SO}_2$ ,  $\text{PM}_{10}$ , Pb, CO,  $\text{C}_3\text{H}_6$  and  $\text{O}_3$
- Under 1995 Environment Act, local authorities must monitor conformity with these limits



# London: Transport data

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- Decennial LATS surveys (from 1961 onwards)
  - 1-day travel diary (40k households per survey)
  - Roadside interview surveys (OD information)
  - Classified traffic counts
  - On-board and station public transport counts
- Continuous monitoring of traffic volumes via ~ 90 ATCs (tubes and inductive loops); gives crude vehicle classification
- Triennial speed surveys via moving car observer method
- Various ad hoc surveys



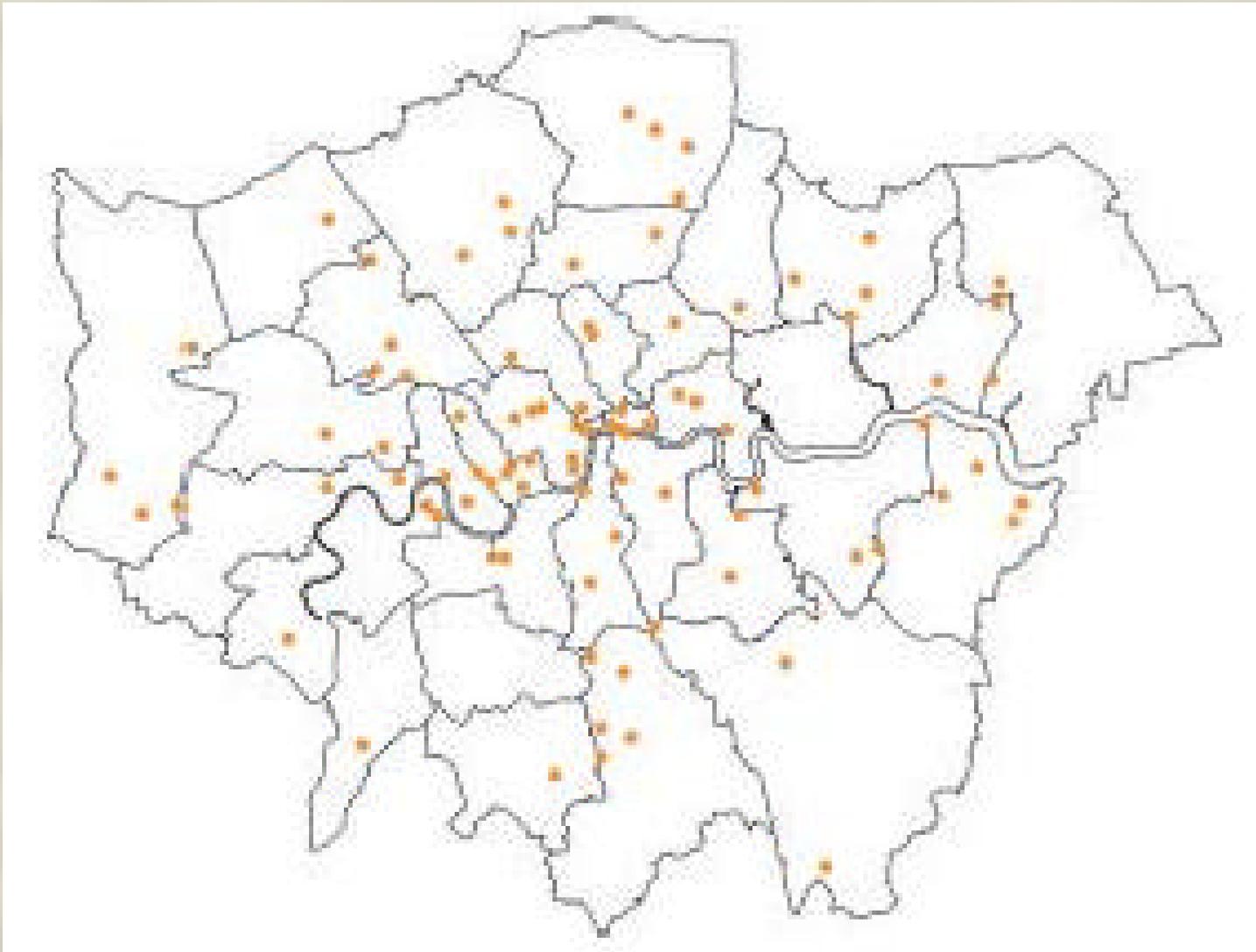
# London: Emissions data

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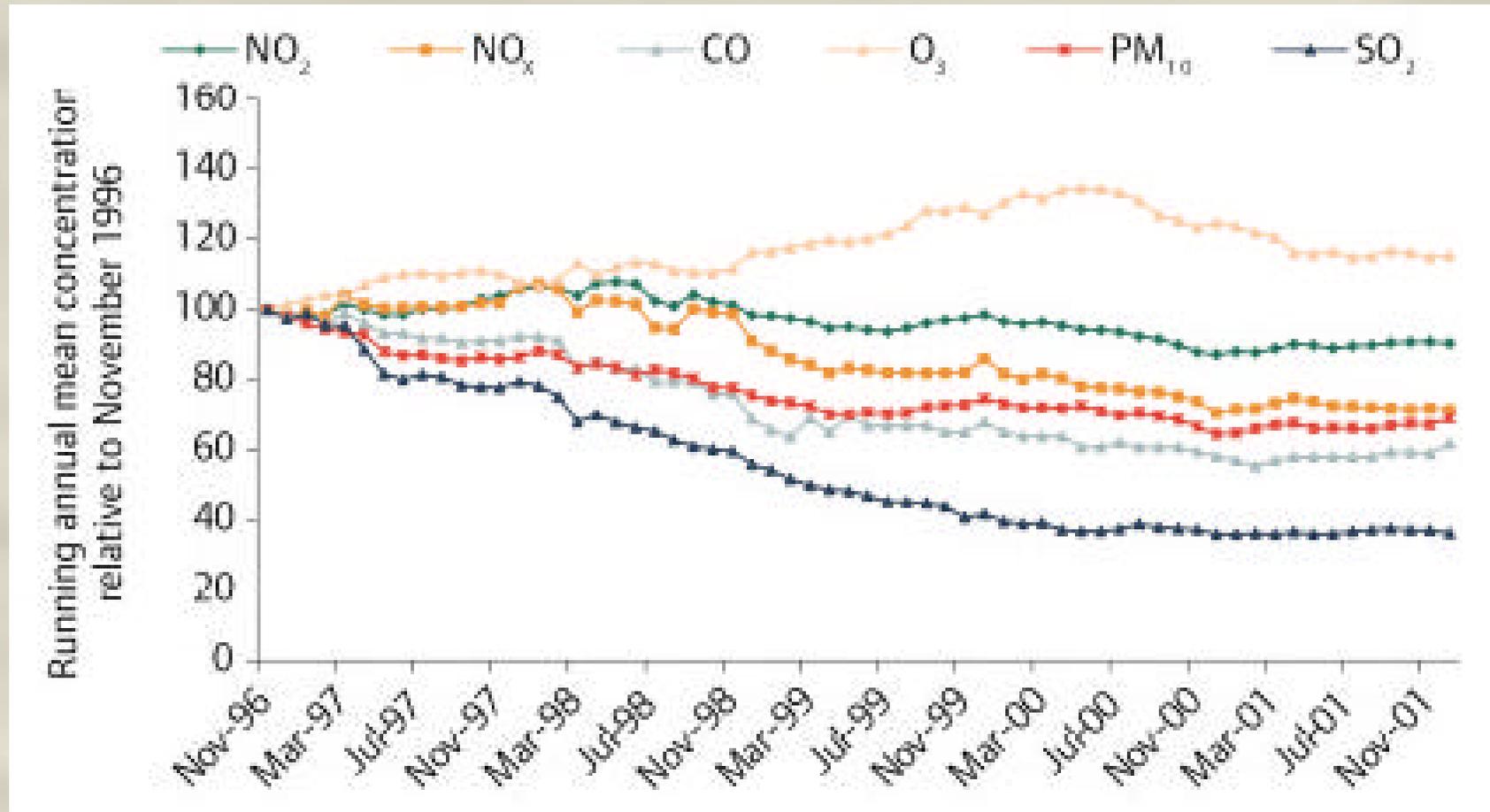
- 94 air quality monitoring sites in London
  - 5 kerbside
  - 42 roadside
  - 33 urban background
  - 14 suburban background
- Most measure  $\text{NO}_2$  and  $\text{PM}_{10}$ ; coverage of other pollutants is more patchy
- Data are freely available on [www.airquality.co.uk](http://www.airquality.co.uk)
- Note the general trend has been of improvement in recent years



# London: Air quality monitoring sites



# London: Recent trends in AQ

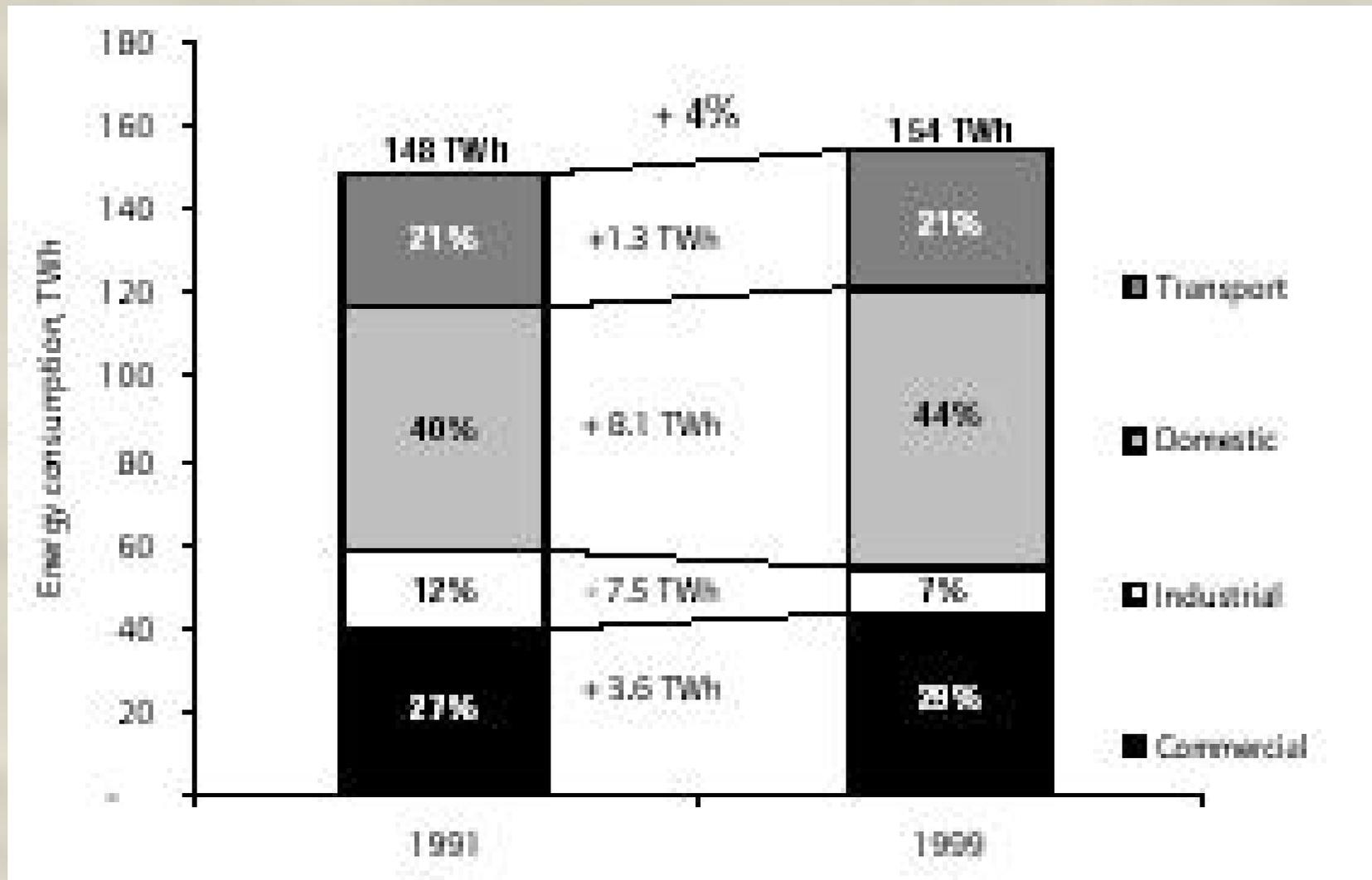


# London: Energy use data

- Data on transport-related energy consumption and CO<sub>2</sub> emissions is assembled from a number of sources:
  - Road transport: Derived from emissions data on the basis of fuel consumption, split by petrol and diesel. Fuel sales data not used.
  - Underground rail: Reported by operator, including imported and self generated
  - Overground rail, shipping and aviation : Derived from emissions data on the basis of fuel consumption
- Fixed assumptions made for energy use and CO<sub>2</sub> emissions per vehicle km.

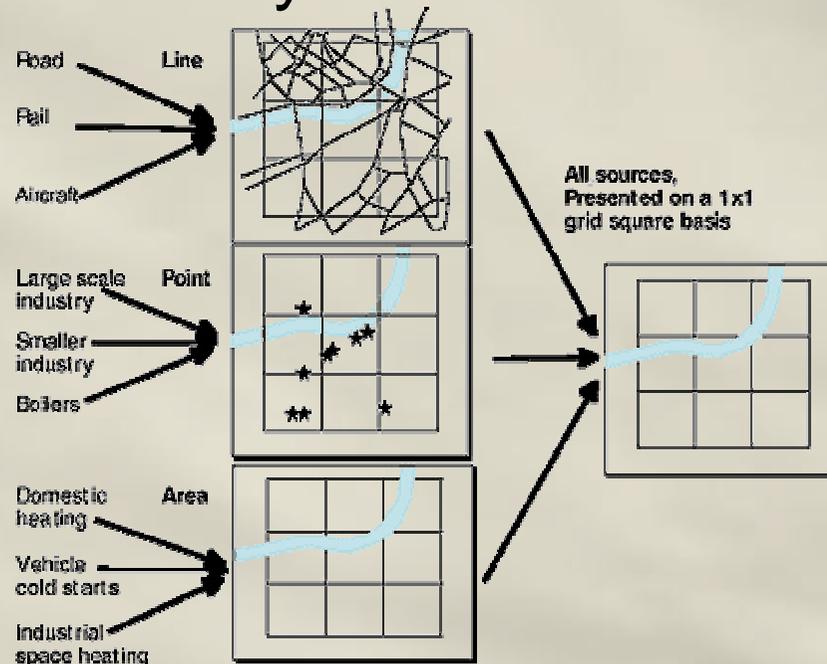


# London: End use energy by sector



# London: Estimation of emissions (1)

- National government sets out general guidelines for emissions estimation for Local Air Quality Management, see [www.defra.gov.uk/environment/airquality/laqm.htm](http://www.defra.gov.uk/environment/airquality/laqm.htm)
- Emission = Activity Rate x Emission Factor



# London: Estimation of emissions (2)

- National Atmospheric Emissions Inventory: 1km<sup>2</sup> grid for the whole of the UK
- More detailed urban emissions inventories also exists for 10+ major urban areas.
- National database of emissions factors available at: [www.naei.org.uk/emissions/](http://www.naei.org.uk/emissions/)
- London has created the London Atmospheric Emissions Inventory (LAEI)



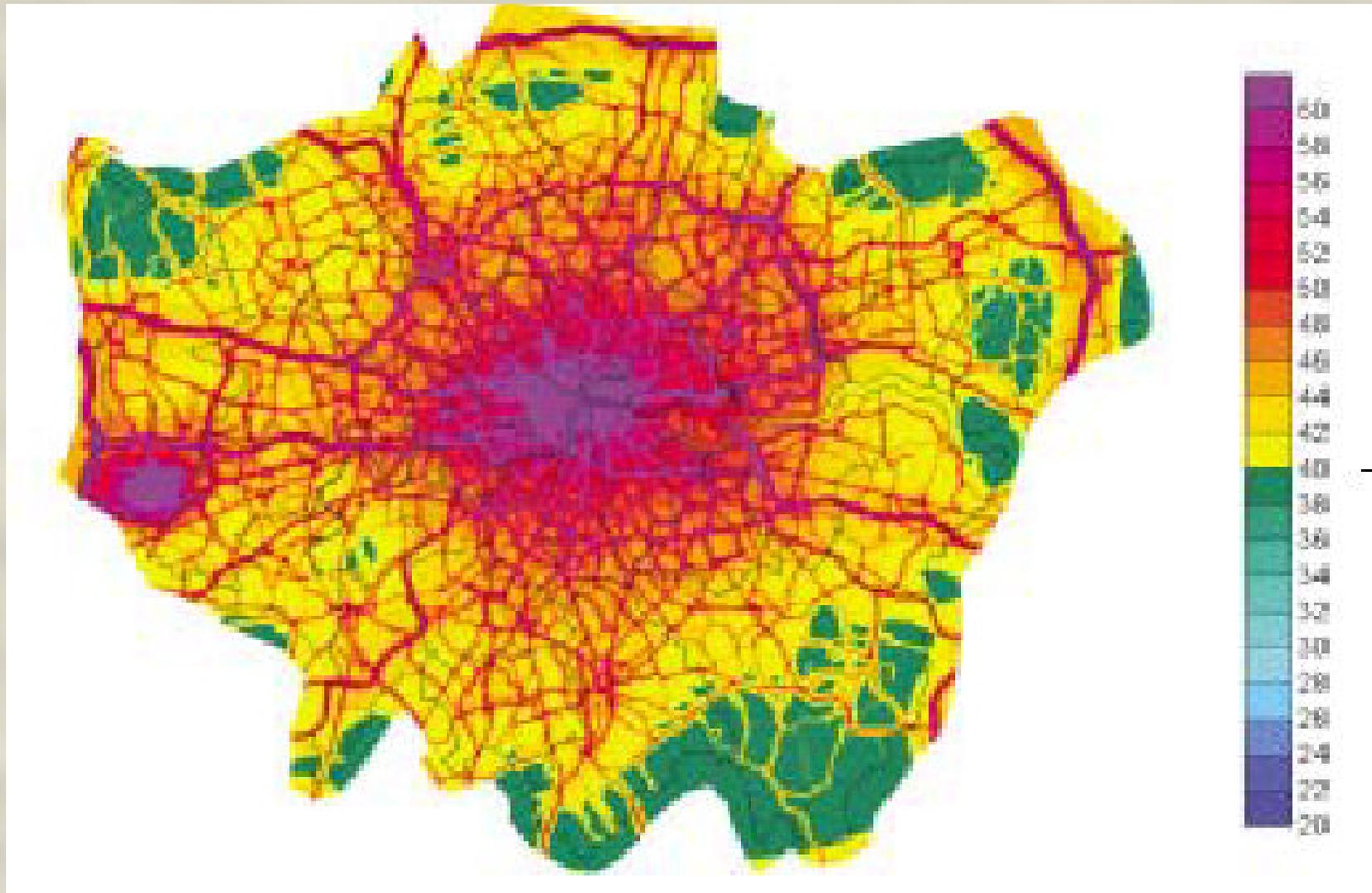
# London: LAEI key features

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- Combines information for London on
  - Traffic: flows, speeds, vehicle classification (via TfL and DfT ongoing surveys plus traffic modelling to augment sparse data coverage)
  - Vehicle fleet composition, at a national level from vehicle license records (via [www.dvla.gov.uk](http://www.dvla.gov.uk))
  - Emissions factors ([www.naei.org.uk/emissions/](http://www.naei.org.uk/emissions/))
- Output of emissions model used as input to a dispersion model (ADMS), to provide estimates of pollutant concentrations



# London: NO<sub>2</sub> concentration (1999)



# London: PM<sub>10</sub> concentration (1999)



# Conclusions

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- London has well-established and relatively sophisticated data collection systems
- The links between *traffic* activity, emissions and concentration are good
- However, two aspects are underdeveloped:
  - At the upstream side, the link with underlying *activity/travel demand* (as opposed to traffic) is poor
  - At the downstream side, the relationship between concentrations and *exposure* is missing
- Both travel demand and exposure are expressions of spatio-temporal behaviour – key future area

